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Title of the Invention

WATERPROOF/BREATHABLE TECHNICAL APPAREL

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OIPE IAP45 MAY 15 2006 PATENT & TRADEMARK OFFICE

WATERPROOF/BREATHABLE TECHNICAL APPAREL

FIELD OF THE INVENTION

The present invention relates to apparel (garments) which is particularly suited to transfer moisture away from an individual. Particularly, the present invention relates to apparel constructed according to a moisture transfer system having a combination of layers that removes moisture away from an individual while also being comfortable and aesthetically pleasing in appearance.

BACKGROUND OF THE INVENTION

Various types of apparel are known in the prior art. However, none of these provide the advantages provided by the present invention. In particular, the types of apparel known in the art do not take advantage of the new advances in materials and fabrics that have been made in recent years. Additionally, new apparel known in the prior art do not teach a moisture transfer system based upon specific combinations of layers as taught in the present invention.

SUMMARY OF THE INVENTION

The present inventor has recognized the deficiencies in the apparel known in the prior art and has designed new apparel that is capable overcoming those deficiencies. More specifically, the present invention discloses a carefully selected combination of layers of specific materials that enable moisture transfer, while at the same time providing comfort to the individual wearing the apparel.

An object of the present invention is to provide apparel that can quickly transfer moisture away from an individuals body so that the individual can feel more comfortable.

Another object of the present invention is to provide individuals involved in activities such as in-line skating, snowboarding, hiking, etc., with active wear that is more functional and can better deal with the additional moisture that is generated by such individuals while involved in such activities.

Yet another object of the present invention is to provide a combination of foam-like materials and fabrics-like materials resulting from the latest technological advances in a manner unknown in the prior art.

These and other objects, features, and advantages of the present invention will become more apparent in view of the following detailed description of the preferred embodiments in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 generally illustrates the layers forming the combination according to an embodiment of the present invention.

Figs. 2-6 illustrate various applications of the different combinations of materials utilized according to the present invention.

DETAILED DESCRIPTION OF THE PREFFERED EMBODIMENTS

A detailed description of the preferred embodiments will now be described in conjunction with the Figures. It should be understood that these embodiments are set forth for purposes of explanation only and are not to be interpreted as the only application the present invention.

The apparel illustrated in Figs. 2-6 include shirts and jackets. Although not specifically illustrated, all other types of apparel can be manufactured according to the present

invention. The application of this invention to other types of apparel could be easily accomplished by one with ordinary skill in the art.

Figure 1 generally illustrates the three layers that are a result of a preferred embodiment of the present invention, namely a first (inner) layer 10, a second layer 20, a third layer 30 and a fourth (outer) layer 40. These layers are attached to each other either by mechanical bonding (or stitch bonding, such as that performed by Tietex, Inc. or Xymid group of ~~Dupont~~DuPont®), lamination (flame lamination, for example), or a combination of these two. Mechanical bonding can be performed using nylon or ~~lycra~~LYCRA® thread or the like. Other equivalent methods may also be employed. Furthermore, as mentioned later, if encapsulation technology is used for the material(s) used as the fourth layer 40, then the fourth layer 40 is preferably not laminated to the third layer 30. This is due to the nature of encapsulated materials. A detailed discussion of the materials preferably used in these layers follows.

The first layer 10 is the layer that is closest to an individuals body. First layer 10 is preferably selected from the following list of inner moisture transfer materials:

Anti-~~F~~ffungal, ~~A~~aanti-~~M~~mmicrobial ~~P~~ppolypropylene and ~~Lycra~~LYCRA® blend (INNOVA);

Anti-~~F~~ffungal, ~~A~~aanti-~~M~~mmicrobial ~~P~~ppolypropylene blend military fleece by Deercreek Fabrics;

Anti-~~F~~ffungal, ~~A~~aanti-~~M~~mmicrobial ~~P~~ppolypropylene cotton blend (ALPHA);

~~Intera~~INTERA-Moisture Transfer Fabrics (by Argmont), which include polyester, or blends including polyester, nylon, wool cotton, etc.;

Field sensor polyester blend knitted fabric Toray AF 123PD;

Looped polyester terry~~/~~ or polypropylene blend;

Aqua dry treated fabric blends of polyester (distributed by Teijin Shojin;

Spun polyester~~/~~ or ~~lycra~~LYCRA® or cotton blend~~,~~ with a wicking finish or the like (distributed by Teijin Shojin);

~~Cool-Max F~~COOL MAX fabrics; or

~~Lycra~~LYCRA®/polyester blends or the like.

The first layer 10 abuts a second layer 20 and is attached thereto by lamination, mechanical bonding, ultra sonic bonding or the like. The second layer 20, in addition to its moisture transfer characteristics, provides some

structural support for the apparel and can either be made of a single material or a combination of materials as set forth below.

Second layer 20 may be a reticulated, open cell or reticulated open cell hydrofilic foam with a non-woven top sheet, made by ~~Dupont~~DuPont®, or the like. All the foam materials discussed herein can be ~~Aquazone~~AQUAZONE, made by Foamex, or the like. The non-woven top sheet may vary in composition. The preferred composition for the top sheet is wood pulp, cotton, rayon, polypropylene, ~~lycra~~LYCRA® (or a combination of two or more of these). The top sheet is usually provided on one side of the foam, but can be provided on both sides of the foam, such as in extreme performance apparel for example. The foam can be of any thickness, preferably between 1/16" and 3/16". The top sheet may also be eliminated in some performance apparel.

If desired, an Outlast membrane may be laminated between first layer 10 and second layer 20 or Frisby Technology may be embedded into the second layer 20. The Outlast membrane by Gateway Technologies may be laminated to the foam or the Frisby Technology may be embedded in the ~~Aquazone~~AQUAZONE, or the like. Both Gateway Technology and Frisby Technology are

microencapsulated technology which depending on the application can provide either warmth or cooling. If Frisby Technologies is selected, hydrophilic foam is used in the layer 20, and is referred to as ~~Comfortemp~~COMFORTEMP. This invention employs ~~Aquazone~~AQUAZONE which may or may not be embedded with the Frisby Technology, but ~~Comfortemp~~COMFORTEMP or a hydrophilic/open cell foam may also be used and may be laminated to the Outlast membrane.

A number of patents have been issued to Triangle Research & Development Corp. disclosing details related to the processes now being employed by Gateway Technologies and Frisby. For example, U.S. Patent Nos. 4,756,958 and 5,366,801 are directed to fibers and fabrics with reversible enhanced thermal properties, respectively. The disclosures of these two patents are hereby incorporated by reference. Other patents assigned to Triangle Research & Development Corp., that are related by subject matter and have overlapping inventorship, include U.S. Patent Nos. 5,415,222, 5,290,904 and 5,244,356. These patents are also hereby incorporated by reference.

The combination of the foam and top sheet forming second layer 20 can be produced in at least two different ways.

According to one way, second layer 20 is produced by laminating a top sheet to the foam. According to another way, the second layer 20 is a cellular elastomeric composite in which the top sheet and the foam have already been combined. In some applications, layer 20 can be omitted.

The third layer 30 abuts the non-woven top sheet of the second layer 20. The third layer 30 includes a breathable membrane, such as preferably TX1540 by Shawmut Mills, ~~Witcoflex Super Dry~~WITCOFLEX SUPER DRY film by Baxenden Chemicals (a water based hydrophilic polyurethane membrane) or the like. The waterproof/breathable membranes may be combined with Outlast ~~membrane~~Technology or may be next to the Frisby Technology embedded into the ~~Aquazone~~AQUAZONE or the like. The breathable/membrane absorbs the outgoing moisture and transfers it to the garment surface while providing a waterproof barrier for the garment. The membrane is laminated to the inner side of the outer fabric. If the outer fabric is encapsulated or structurally woven to repel water the breathable membrane is not necessary. For colder conditions, such as for temperatures below 32°F, an additional insulating layer may also provided along with the Outlast membrane or Frisby Technologies. This insulating layer is preferably

~~Themolite~~THERMOLITE thin or ~~Extreme~~EXTREME (manufactured by ~~Dupont~~DuPont®) or a hydrofilic foam. Frisby Technology can be used in conjunction with the foam materials and especially in conjunction with ~~Thermolite~~THERMOLITE. Alternatively, this layer, like others, can be omitted entirely in certain applications.

The fourth, or outer, layer 40 abuts either the breathable membrane or the insulating material, if used, of the third layer 30. If the outer layer is a material that is encapsulated or if it is a performance fabric such as ~~Dermizax~~DERMIZAX by Toray or ~~Microft~~MICROFT, which is distributed by Teijin Limited, then the third layer 30 abuts the fourth layer 40, but is not laminated thereto. The following is a list of outer moisture transfer materials that could be used as the outer layer 40:

Cotton polyester blend with a breathable membrane (several choices);

Cotton blend encapsulated;

Cotton denim or ~~Chino~~chino encapsulated~~/~~ or waterproof breathable membrane;

2/3 ply supplex encapsulated~~/~~ or waterproof breathable membrane;

6-ply ~~Taslan~~TASLAN encapsulated~~/~~ or waterproof breathable membrane;

~~Tudor~~TUDOR by Travis encapsulated~~/~~ or waterproof breathable membrane;

~~Mojave/Twister~~MOJAVE/TWISTER by Travis encapsulated~~/~~ or waterproof breathable;

Codura® encapsulated~~/~~ or waterproof breathable membrane;

~~Kelvars~~KEVLARS by Schoeller encapsulated or membrane;

~~Micro-Technical II Sanded~~MICRO-TECHNICAL II SANDED or ~~Micro-Technical III Sanded~~MICRO-TECHNICAL III SANDED by Brookwood encapsulated or breathable membrane;

~~Citation Sanded~~CITATION SANDED or ~~Jet-Laund~~JET-LAUND by Brookwood encapsulated or breathable membrane;

Encapsulated supplex by Toray;

~~Dermizax~~DERMIZAX Fabrics by Toray;

~~Entrant Gil~~ENTRANT GIL by Toray;

~~Super-Microft~~MICROFTSUPER-MICROFT distributed by Teijin Shojin or ASF;

~~Gymstar Plus~~GYMSTAR PLUSGYMSTAR PLUS by Unitika;

~~Tuflex-HR~~TUFLEX-HR by Unitika;

Schoeller ~~Dryskin~~DRYSKIN;

Schoeller ~~Dynamic~~DYNAMIC ~~Extreme~~EXTREME;

Schoeller ~~Keprotec~~KEPROTEC;

Schoeller ~~Dynatec~~DYNATEC;

Schoeller ~~Keprotec~~KEPROTECT with ~~Inox~~INOX;

Micro-polyester ~~F~~fabrics distributed by Teijin Shojin;

Structurally knitted acrylic, wool, with or without encapsulation (made by Toray), distributed by Teijin Shojin or ASF Group, Kyodo Sangyo Co. Ltd. (a structurally knitted fabric that repels water~~.~~);

Vinyl materials with a nonwoven backing and plastics fabrics, by Tessile Florentina, Baikfan or Teijin Shojin, these groups include ~~Errebi~~ERREBI, 101659-01669-01676-1271, 57006-800 and 43005-870;

~~Stomatex~~STOMATEX, which is a neoprene type of material that is breathable;

~~Darlexx~~DARLEXX, which is a ~~lycra~~LYCRA® type of material and is to be used in the underarm portions of certain apparel

Ripstop Hardline fabric; and

Wool and wool blends which include one or more of the following: acrylic, ~~lycra~~LYCRA®, polyester and nylon. These fabrics are made of yarns and are hydrophobic. Wool and wool blends are provided by Euromotte, Inc. of Belgium and/or toray in Japan. These fabrics are either pure wool, wool blends or

acrylics that are knitted with hydrophilic yarns so as to be waterproof. This is in effect an encapsulation process.

All of the above, used as the fourth layer 40, are laminated with a breathable membrane, encapsulated, covered by a waterproof film or are woven man-made fabrics structurally knitted or woven to repel water. The structurally woven or knitted fabrics do not require encapsulation or breathable membranes to waterproof the garment. The preferred waterproof fabrics are ~~Microft~~MICROFT by Teijin Shojin, ~~Gymstar Plus~~GYMSTAR PLUS and ~~Tuflex-HR~~TUFLEX-HR both by Unitika, Ltd. Another preferable fabric is a structurally knitted acrylic or acrylic blends, which may be encapsulated and distributed by ASF and made by Toray, for example. A number of marketed waterproof exterior films could be added as an option for snowboard apparel, especially for areas covering an individuals knees, elbows and buttress area. These films (DWRs) are applied by fabric manufacturers themselves. This film may or may not be used with encapsulation but may be used in combination with the waterproof/breathable membrane systems. High abrasive materials, preferably ~~Kevlar~~KEVLAR fabrics by Schoellar may also be added along areas of pants, elbows, pocket lines, cuffs and buttress areas.

All technical apparel will preferably have seams hot melted or adhesively sealed to prevent moisture from entering along stitch lines. The Extreme apparel will add zipped underarm vents to aid in moisture release and will contain a hydrophilic open cell foam collar band and wrist band cover by inner fabric selection to absorb excess moisture and transport it away from an individual. A rain gut along the front shirt zipper line may be added to aid in moisture transfer.

Figures 2-6 illustrate various applications of the present invention as contemplated by the inventor. These applications are discussed by way of example only. More specifically, Figures 2-6 illustrate various styles of shirts~~/~~ or jackets incorporating the present invention is different combinations. The reference numerals 101-109 represent various areas of the different types apparel constructed from the following combinations of materials. It is once again mentioned that Outlast can be combined with the materials listed below, although not specifically mentioned. In other words, Outlast or Frisby Technologies can be combined with the foam materials, the breathable membranes, the ~~thermolite~~THERMOLITE or any of the outer fabrics. Outlast or Frisby Technologies can also be combined with encapsulation,

by Nextec, for use in the outer layer 40. Of course, Outlast or Frisby Technologies can also be used by itself.

Numeral 100 is preferably formed by a layer 40 formed from a cotton blend fabric that is encapsulated and may include denim and chino fabrics. Inside of layer 40 is a layer 20 which is a cellular elastomeric composite of a hydrophilic 1/8" foam having a non-woven top sheet. Inside of layer 20 is a layer 10 of any of the inner liner materials listed above in connection with layer 10. According to this application, layer 30 is omitted.

Numeral 200 has a layer 40 of an encapsulated cotton blend ~~encapsulated~~abutting ~~Themolite Extreme~~THERMOLITE EXTREME, ~~Microloft~~MICROLOFT or the like, or abutting a hydrophilic~~/~~, open cell foam or a reticulated foam (either or in combination as a composite). Inside ~~of~~ layer 40 is a layer 20 which is a non-woven ~~backed~~ and foam, the foam being preferably ~~Aquazone~~AQUAZONE. Inside layer 20 is a layer 10 which can be any of the inner liner materials mentioned above in connection with layer 10. Layer 30 is omitted.

Numeral 300 has a layer 40 that is a ~~cotton/acrylic/polyester~~ cotton, acrylic, polyester or a blend. Inside layer 40 is a layer 30 which is a waterproof

breathable membrane. Inside layer 30 is a layer 10 which is one of various inner liner materials. Layer 20 is omitted.

Numeral 400 has a layer 40 that is a cotton/acrylic/polyester blend. Inside layer 40 is layer 30 which is a waterproof breathable membrane. Inside layer 30 is a layer 20 which is either ~~Themolite~~THERMOLITE or reticulated/open cell hydrofilic foam with or without Frisby Technology. If foam is used, ~~Aquazone~~AQUAZONE is preferred. Also, the ~~Themolite~~THERMOLITE and foam may be combined. Inside layer 20 is layer 10 of one of the inner liner materials.

Numeral 500 has a layer 40 of 2/4 Supplex, 6-ply ~~Taslan~~TASLAN, Cordura, Micro-Technical II and III, ~~Citation Sanded~~CITATION SANDED, ~~Tudor~~TUDOR, ~~Mojave~~MOJAVE, ~~Twister~~TWISTER Travis ~~F~~fabrics, ~~Kelvar~~KEVLAR fabrics, laminated breathable membrane or encapsulated outer fabrics. Inside layer 40 is a layer 30 of ~~Thermolite~~THERMOLITE. Instead of ~~Thermolite~~THERMOLITE, a reticulated/open cell hydrophilic foam may be used, or may be combined with the ~~Thermolite~~THERMOLITE. Inside layer 30 is a layer 20 of a cellular elastomeric composite. Inside layer 20 is a layer 10 of one of the inner liner materials.

Numeral 600 has a layer 40 of ~~Gymstar Plus~~GYMSTAR PLUS or ~~Microft-Super~~SUPER-MICROFT structural constructed water-repellent fabrics. Inside layer 40 is a layer 20 of a non-woven and foam composite with or without a breathable membrane 30 between layers 40 and 20. Inside layer 20 is a layer 10 of one of the inner liner materials.

Numeral 700 has a layer 40 of ~~Gymstar Plus~~GYMSTAR PLUS, ~~Super Microft~~SUPER-MICROFT, ~~Tuflex-HR~~TUFLEX-HR, abutting ~~Themolite Extreme~~THERMOLITE EXTREME or hydrofilic foam or a combination of these. Inside this layer 40 is a layer 20 which is a cellular elastomeric composite or a foam with a non-woven top sheet laminated thereto. A breathable membrane 30 can optionally be added between layers 20 and 40.

Numeral 800 has a layer 40 made of one of the possible fabrics mentioned above, except ~~Gymstar Plus~~GYMSTAR PLUS or ~~Super-Microft~~SUPER-MICROFT waterproof breathable membrane. Inside layer 40 is a layer 20 which is a cellular elastomeric composite. Inside layer 20 is a layer 10 of one of the inner liner materials.

Numeral 900 has a layer 40 made of one of the possible fabrics mentioned above, except ~~Gymstar Plus~~GYMSTAR PLUS or ~~Super-Microft~~SUPER-MICROFT waterproof breathable membrane.

Inside layer 40 is a layer 30 of Themolite or a layer 20 of reticulated or hydrophilic open cell foam with a nonwoven top sheet. Inside layer 30 or layer 20 is a layer 10 of one of the inner liner materials.

The examples presented above illustrate how various combinations of the present invention can be realized is different parts of different types of apparel. Other variations are also possible given the range of combinations that are possible.

The microfiber technology disclosed above is rapidly developing and changing and has greatly increased the potential for improved performance of such products such as performance apparel, provided that they are properly utilized as in the present invention. These new products are part of rapidly developing fabric technology. The present invention employs a combination of fabrics, foam layers, nonwovens, spacer fabrics, breathable membranes, encapsulated technology, structural woven water repellent fabrics, or waterproof film coatings in such combinations that increase the performance of the products in which they are used as well as increase breathability. The waterproof/breathable membranes have also

only recently developed and are believed to be less than ten years old.

While the present invention has been described above in connection with the preferred embodiments, one of ordinary skill in the art would be enabled by this disclosure to make various modifications to these embodiments and still be within the scope and spirit of the present invention as embodied in the appended claims.

WHAT IS CLAIMED IS:

1. A moisture transfer apparel worn by an individual comprising, on at least a portion of the apparel, a combination of layers constructed as follows:

a first layer, closest to the individual, selected from a group of inner moisture transfer materials;

a second layer, abutting the first layer, including a foam material;

a third layer, abutting the second layer, including a breathable membrane; and

a fourth layer, abutting the third layer, selected from a group of outer moisture transfer materials.

2. The moisture transfer apparel according to claim 1, wherein at least two of the first, second, third and fourth layers are attached to each other by lamination.

3. The moisture transfer apparel according to claim 1, wherein at least two of the first, second, third and fourth layers are attached to each other by mechanical bonding.

4. The moisture transfer apparel according to claim 1, wherein the fourth layer is laminated with a breathable membrane.

5. The moisture transfer apparel according to claim 1, wherein the fourth layer is treated by encapsulation.

6. The moisture transfer apparel according to claim 1, wherein the fourth layer is coated by a waterproof film.

7. The moisture transfer apparel according to claim 1, wherein the outer moisture transfer materials are fabrics that are structurally knitted or woven to repel water.

ABSTRACT OF THE DISCLOSURE

The apparel is constructed from various combinations of layers of materials with moisture transfer properties. A first liner of moisture transfer fabrics abuts a second layer of structural material such as a foam. The second layer can abut a breathable membrane and/or an insulating material. Finally, carefully selected outer fabrics complete the combination to provide apparel with improved performance characteristics. The outer fabrics are treated in various ways to enhance performance.